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NWSO MORRISTOWN, TENNESSEE SEVERE WEATHER CLIMATOLOGY

David Hotz and Joanne Labounty
National Weather Service Office
Morristown, Tennessee

Scientific Services Division
Southern Region
Fort Worth, TX

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UNITED STATES
DEPARTMENT OF COMMERCE
'lliam M. Daley, Secretary

National Oceanic and Atmospheric Administration
D. James Baker
Under Secretary and Administrator

National Weather Service
John J. Kelly, Jr.
Assistant Administrator
for Weather Services

1. Introduction

As a result of the modernization of the National Weather Service (NWS), most of the County Warning Areas (CWA) of NWS offices at Chattanooga, Knoxville, and Tri-Cities, Tennessee, were transferred to the new NEXRAD Weather Service Office (NWSO) Knoxville/Tri-Cities (Morristown), Tennessee. The Morristown CWA covers 39 counties from southwest Virginia to southeast Tennessee (Fig. 1). Since the NWSO at Morristown may receive additional CWA responsibilities across northwest Georgia by late 1998, we have included these counties within our study. Further references will simply be to "the CWA."

Since radars have always been critical to the detection of severe storms, a brief summary of the Weather Service Radars (WSR) that have been available to NWS personnel prior to the WSR-88D will be worthwhile. The WSO at Tri-Cities used the 10 cm WSR-57, which was a network radar, and the WSO at Chattanooga used the 5 cm WSR-74C, which was a local warning radar. The WSO at Knoxville did not have an NWS radar locally, but utilized the RADID system to dial into the surrounding radars.

The National Weather Service has defined a severe thunderstorm to be the occurrence of one or more of the following weather phenomena: one or more tornadoes, hail greater than or equal to 0.75 in diameter, and convective wind gusts equal to or greater than 50 kt or convective wind damage. This paper will look at the occurrences of each severe weather event both spatially and temporally. The purpose of this paper is to acquaint new forecasters with the severe weather climatology of the NWSO Knoxville/Tri-Cities CWA, and to provide a basis for additional severe weather studies.

2. Data

Most of the data were obtained from the NCEP/Storm Prediction Center (SPC) tornado, hail, and wind damage database, which can be found on the SPC web site (http://www.nssl.noaa.gov/~spc). The tornado database dates back to 1950 while the hail and wind database dates back to 1955. A local program was developed to quickly screen the database to determine the severe weather climatology. Since 1996 data were not included in the SPC database, the Storm Data publication from the National Climatic Data Center was used to fill in that year (NOAA 1996).

A number of tornado climatology studies have pointed out that one of the major limitations in producing a severe weather climatology is a bias which derives from population density. To provide the reader with a better sense of the population across the CWA, Figure 2 shows the population of each county in the CWA, as of the 1990 U.S. census. Other biases may come from weather sensitivity of the media and the general public, as well as the level of effort expended by the NWS, local emergency management officials, and spotter groups to seek out and validate severe weather reports. Studies by Ostby (1993) have suggested that a more reliable climatology study may be found by focusing on the most severe events, such as those with F2 tornado intensities or higher. Stronger tornadoes are less likely to go unreported. That was not done in the present study.

3. Topography

The topography of the CWA varies greatly and has a major impact on thunderstorm development and corresponding severe weather climatology. Mountainous terrain exists across the eastern-most counties of the CWA, with several mountain peaks in excess of 6,000 ft MSL (Fig. 3). Just west of the mountains lies the Great Tennessee Valley, which runs from northwest Georgia northeast to northeast Tennessee. The elevation of this valley ranges from 800 - 1000 ft across southeast Tennessee and northwest Georgia, to 1500 - 2000 ft across northeast Tennessee. Numerous ridges can be found in the valley with elevations up to 2500 ft. The main population centers of the CWA, including Chattanooga, Knoxville, and Tri-Cities, are located in the Great Tennessee Valley.

Over the northwest section of the CWA lies the northern Cumberland Plateau, where the elevation rises from the valley floor to 3,500 ft. The terrain across southwest Virginia is quite mountainous, with peaks over 4000 ft and valleys around 2000 ft.

4. Tornado Climatology

a) *yearly frequency*

During the period of record (1950-1996), there were a total of 149 tornadoes, 65 of which were category F2 or greater (Fig. 4). A list of these events can be found in the Appendix. Since 1950, tornadoes caused 38 deaths and 782 injuries throughout east Tennessee, extreme southwest Virginia, southwest North Carolina and northwest Georgia. Tornadoes have not been reported in every county in the CWA. Northeast portions of the CWA have seen the fewest number of tornadoes, while the central and southern parts have seen the most (Fig. 5).

Although such factors as population bias and increased emphasis on warning verification have influenced the tornado database (Ostby 1993), some points can still be made from the yearly tornado climatology of the Morristown CWA. The lack of a strenuous warning verification program may very well explain the sparsity of tornado reports in the CWA throughout the 1950s and 1960s, however, it does not explain the lack of reports during the 1980s, since the NWS began a vigorous verification program in 1980. Meteorological or other factors must have affected the occurrence of tornadoes during those years. Support for this comes from Grazulis (1993), who noted a national decrease in tornadoes for that period.

b) *monthly frequency*

Tornadoes have occurred in every month of the year in the CWA (Fig. 6). The greatest number occurred in April, and the fewest in September. Although the April figures are highly skewed by the 1974 super-outbreak on April 3, during which there were 27, this month still sees the highest occurrence even with the data from the super-outbreak removed. April is a bit earlier than the May peak that national statistics show (Grazulis 1993). This may be because warm, unstable air enters Tennessee earlier due to its southern latitude. Such studies show, however, that the monthly distribution can be quite different from state to state.

A much smaller secondary maximum in tornadoes is experienced in November. This is not surprising since studies by Ostby (1993) and Grazulis (1993) have shown that a "second season" of tornadoes occurs in November for most locations in the southern United States. This secondary maximum is slight for the Morristown CWA, probably because the area is on the northern fringe of the southern United States, where warm unstable air is not uncommon in late fall.

c) *hourly occurrence*

Tornadoes were also categorized by their times of occurrence (Fig. 7). A pronounced peak in tornado occurrence is during the afternoon, with a maximum at 4 p.m. local time. The mid- to late afternoon hours have been widely recognized as the peak time for tornadoes in most of the United States (Grazulis 1993). Grazulis has also shown that the peak time nationally for all known tornadoes is between 5 and 6 p.m.. However, each state has its own unique diurnal distribution. For Tennessee, peaks have been shown to occur generally between 4 and 7 p.m. (with the greatest peak at 5 p.m.). The least likely time for tornadoes is in pre-dawn hours from 4 to 5 a.m..

d) *tornado strength, path length and width*

The Fujita (1981) scale of tornado intensity (Table 1) was derived from an examination of tornado damage. Figure 8 shows the number of tornadoes in each Fujita category for the Morristown CWA. Of all tornadoes in the Morristown CWA, 54 percent have been categorized as weak (F0-F1), 41 percent were strong (F2-F3), and about 5 percent were violent (F4-F5). Nationally, those figures are 68 percent weak, 30 percent strong and 2 percent violent.

There has never been a category F5 tornado (261-318 mph) in the Morristown CWA during the period of record. The deadliest tornado reported was a category F4 which occurred in Fentress County, the northwestern-most county in the CWA, during the April 1974 super-outbreak. There were seven fatalities and 150 injuries with that tornado. However, it has been shown that because of a number of factors (subjective nature of estimating process, surveying techniques, etc.), there is about a 50 percent chance of a one category miscalculation in the F-scale rating for any F0 through F4 tornado (Ostby 1993).

Table 1

Fujita Tornado Scale	Wind Speed	Damage description
F0	40-72 mph	light
F1	73-112 mph	moderate
F2	113-157 mph	significant
F3	158-206 mph	severe
F4	207-260 mph	devastating
F5	261-318 mph	incredible

Figure 9 shows the path lengths of the tornadoes in the CWA. Most of the tornadoes (38 percent) were on the ground for less than one mile. There has never been a tornado on the ground for over 100 miles during the period of record. Furthermore, the majority of tornadoes have consisted of a small path width (45 percent were 165 feet or less) and there has never been a tornado reported to have exceeded one mile in width (Fig. 10). One tornado (F2) was reported to be one mile wide, occurring in Jefferson County on March 25, 1955.

f) *deaths and injuries*

The largest number of tornado deaths and injuries in the Morristown CWA were in the month of April, due largely to the events of April 3, 1974 (Fig. 11). There were 31 deaths and 586 injuries in that single event. Table 2 shows the breakdown for all months. The next greatest number occurred in February (also due largely to one event; in this case, one tornado). The majority of the deaths and injuries occurred in the afternoon hours, corresponding well to the higher frequency of tornadoes during those hours. Nationally, Tennessee ranks first in having the highest number of tornadoes with injuries as a percentage of all tornadoes (38 percent). This agrees well with the percentage of tornadoes with injuries in the Morristown CWA (41 percent).

Table 2. Monthly Percentage of Tornado Deaths and Injuries

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.00	11.3	4.3	75.2	4.8	0.5	1.5	0.1	0.00	1.5	0.2	0.6

5. Hail

a) *yearly distribution*

Large hail (equal to or greater than 0.75 in diameter) is a fairly common occurrence throughout the CWA, with reports observed every year since 1955, and in every county (Figs. 12 and 13). The number of reports has increased significantly since the opening of the Morristown office in 1995, likely because of its more aggressive verification techniques. Nationally, a study by Sammler (1993) has shown that the number of hail reports more than doubled in the decade 1981-1990, compared to the previous decade, due in large part to implementation of the NWS warning verification program in 1980. The data for large hail reports, as with those for tornadoes, seems skewed toward higher population density areas throughout the CWA (Fig. 12).

b) *monthly frequency*

The climatology of large hail shows a peak frequency in May (Fig. 14), a bit later than the April tornado maximum. Although large hail is possible in every month of the year, the number of events curves up to its May maximum and descends to a minimum in October. This is consistent with the national average, which also shows a hail maximum in May (Sammler 1993). There is also a very slight maximum of hail events in November, as is the case with tornadoes.

c) *hourly occurrence*

As with tornadoes, the greatest number of hail events occurs during the afternoon hours, with a peak at 4 p.m. local time. The least likely time of large hail occurrence is once again during the early morning hours (Fig. 15).

d) *size distribution*

Table 3 shows the size estimation guide used by the National Weather Service to obtain hail sizes from spotters, law enforcement agencies and the public. Three-quarter inch diameter hail verifies a severe thunderstorm warning. Figure 16 shows that most reports of large hail in the Morristown CWA have been in the 0.75-1.74 inch category (large hail). The large increase - nearly doubling - of hail reports in the last decade, as discussed above, has been due to a dramatic rise in the smaller hail category (one inch diameter or less) since 1980. However, the number of hail reports greater than 1.75 inches has remained nearly constant since 1970. While prior to 1983 the highest percentage of hail reports was in the 1.00-1.75 inch category, since 1983 hail sizes of one inch or less have ballooned to where they now account for over 50 percent of all hail reported (Sammler 1993). Note in Figure 16 that only 2 percent of hail reports in the Morristown CWA have been categorized as "enormous." This is consistent with studies that have shown the rarity of such large hail in the Southeast (Doswell et al. 1983).

Table 3

Hail Size	Size Estimate
3/4 inch	Dime
1 inch	Quarter
1.75 inch	Golf Ball
2.75 inches	Baseball

6. Damaging Winds

During the month of June, the dominant severe weather type in the CWA shifts to wind damage (Fig. 17). Nationally, the number of severe wind reports peaks in June and July (Doswell et al. 1983). The NWS defines severe thunderstorm winds as those of 50 kt (58 mph) or greater. As is the case with hail, severe thunderstorm winds are common throughout our area. These wind events have also been reported every year since 1955 and in every county (Figs. 18 and 19). There are the same potential biases with reports for these events as with hail and tornadoes. The greater number of reports tend to occur in higher population areas, and the number of reports has increased significantly since the assumption of CWA responsibility by NWSO Morristown.

The same pattern holds true for the times of reported wind damage as with all other types of severe weather reports (Fig. 20). The greatest number of severe thunderstorm wind events occurs in afternoon hours (4 p.m.), while the fewest number occurs during the morning hours.

7. Conclusion

The purpose of this study was to determine the severe weather climatology across the new county warning area for NWSO Morristown. A number of temporal and spatial patterns are evident. During the past 30 years, there has been a distinct increase in the number of severe weather events reported to the NWS. The increase has been most dramatic since NWSO Morristown, with the new WSR-88D radar, began to serve the area. The increase has been most pronounced in the number of severe wind and hail events, likely because of the increased sensitivity of the new radar to these phenomena, and to the increased awareness of the NWS, local emergency managers, spotters, and the general public.

The occurrence of tornadoes and hail is most frequent during the spring, especially April, while the peak time for damaging winds tends to occur a bit later in June. The decrease in tornadoes and hail occurrences during the summer can be attributed to the shift of the main westerlies well to the north of the CWA, decreasing the vertical shear. Also, the corresponding increase in the height of the freezing level makes the conditions less favorable for hail development.

Most of the severe weather during the summer is due to wind damage, which is usually associated with pulse severe thunderstorms producing locally strong microbursts. As would be expected, the peak time for all types of severe weather occurs from mid-afternoon to early evening.

The maps showing the number of events per county were useful in determining areas which are more susceptible to severe weather. A majority of the tornadoes in the CWA have occurred across southeast Tennessee and the northern Cumberland Plateau. The maximum across southeast Tennessee may be attributed to closer proximity to the moisture originating from the Gulf of Mexico. The maximum over the Cumberland Plateau may be the result of weak to moderate upslope flow during southerly winds. Also, both areas are typically less affected by stable cold air damming in the Great Tennessee Valley.

A distinct minimum in severe events was noted over the mountains of northeast Tennessee, southwest Virginia, and the northern counties of the Great Tennessee Valley. This minimum is likely due to mountainous terrain disrupting inflow into thunderstorms. The northeast to southwest orientation of the Appalachians in far eastern Tennessee tends to block deep low-level moisture penetration into the northern sections of the CWA. Cold air damming in the Great Tennessee Valley during the spring also tends to inhibit moisture and instability in these northern sections.

It is hoped that this study will aid the staff at the NWSO Knoxville/Tri-Cities in understanding the severe weather climatology of the CWA. We hope that this study will provide a foundation for further studies, which are needed to improve our forecast and warning program. Others who are interested in the severe weather climatology of the area may also find these results helpful.

Acknowledgments

The authors wish to express their appreciation to Steve Hunter (SOO, NWSO Knoxville/Tri-Cities) for reviewing this paper and providing very helpful comments and suggestions. Thanks go also to Robyn Malone (Administrative Assistant, NWSO Knoxville/Tri-Cities) for helping us produce the severe weather maps.

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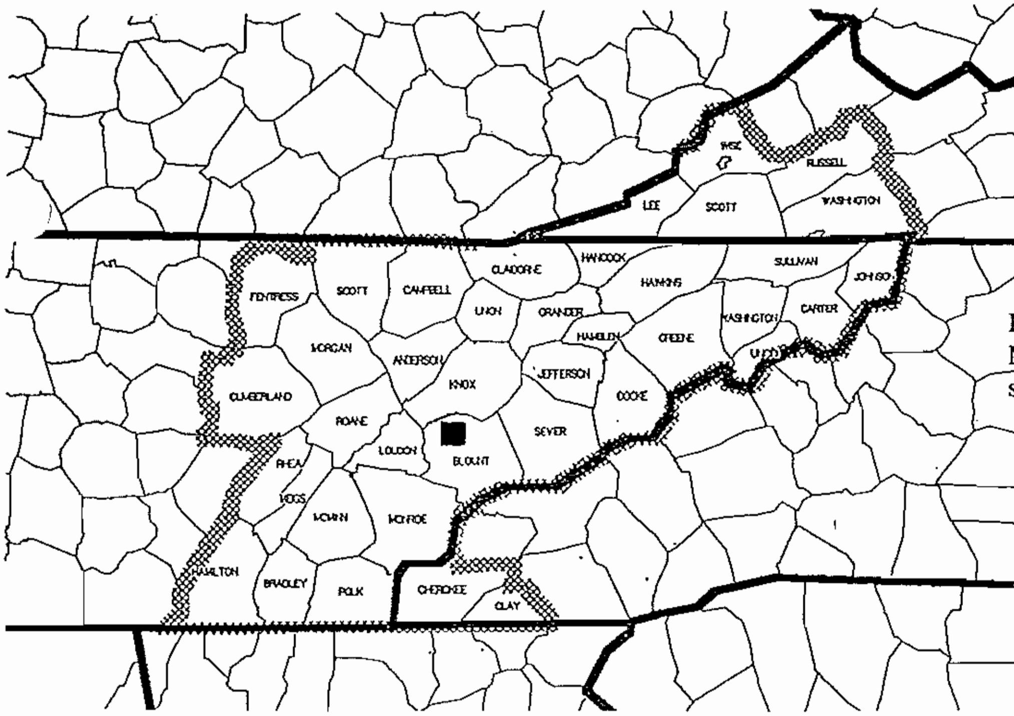


Figure 1. County Warning Area for NWSO Morristown, Tennessee. NWSO location shown by ■.

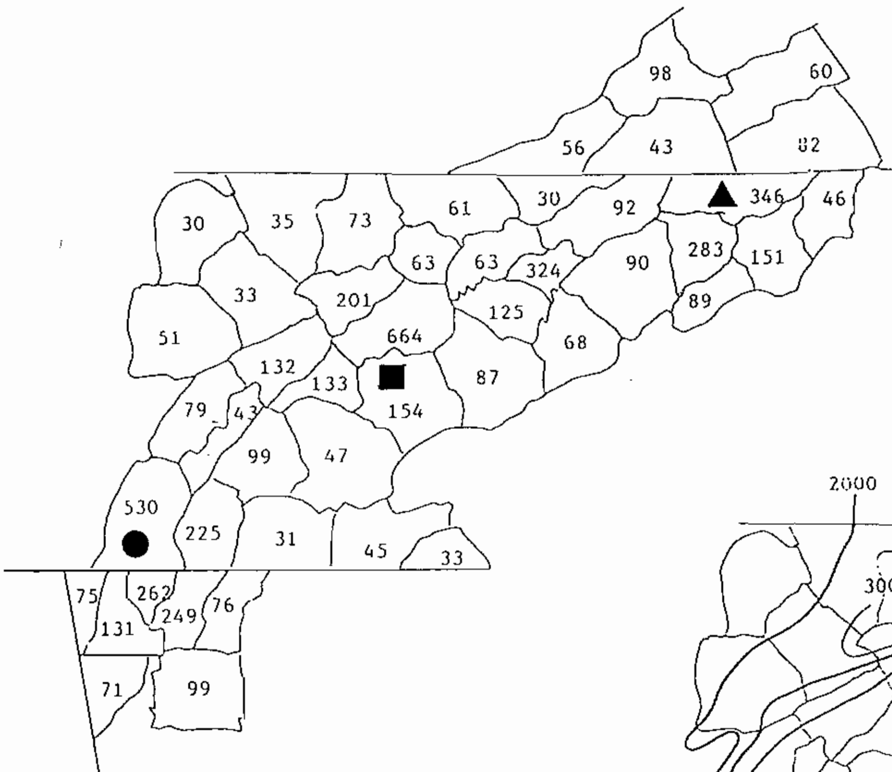


Figure 2. Population density (per sq. mi.) for counties in NWSO Morristown CWA. 1990 census data. Knoxville (●) and Tri Cities (▲) shown.

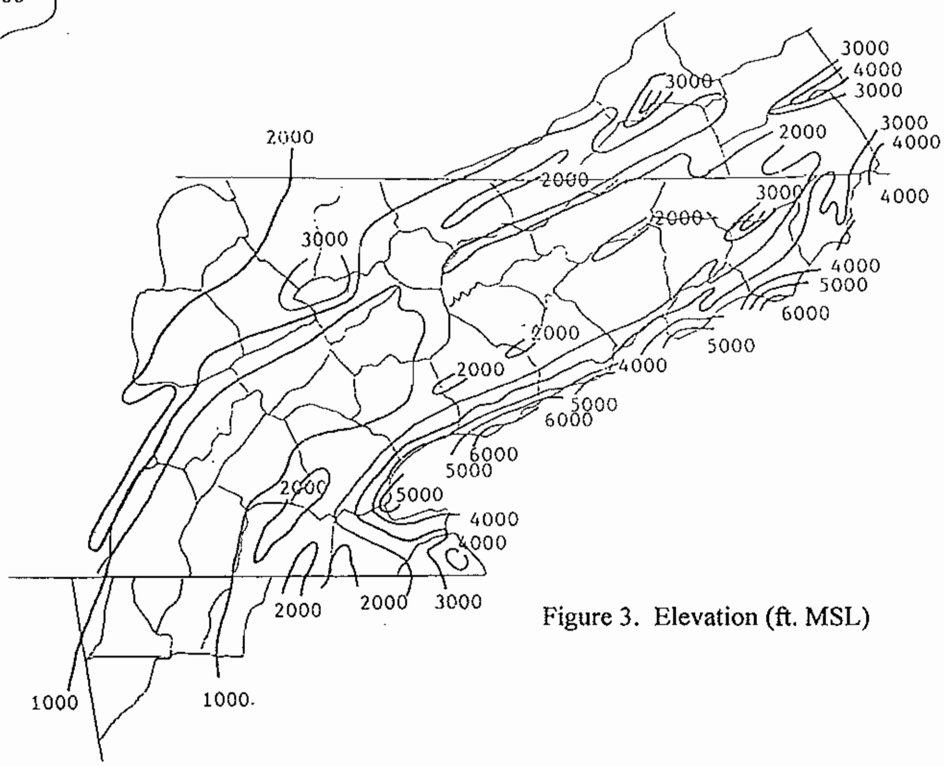


Figure 3. Elevation (ft. MSL)

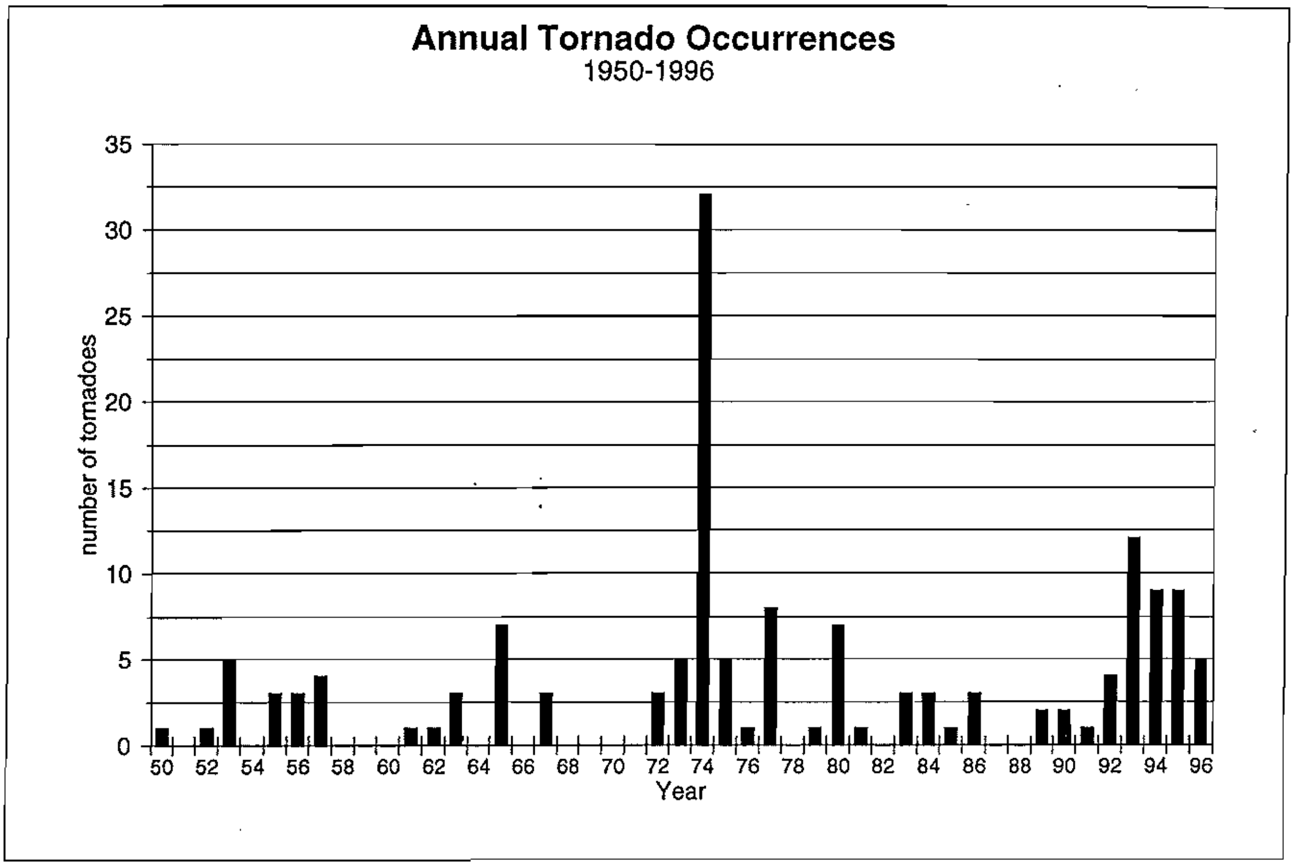


Figure 4.

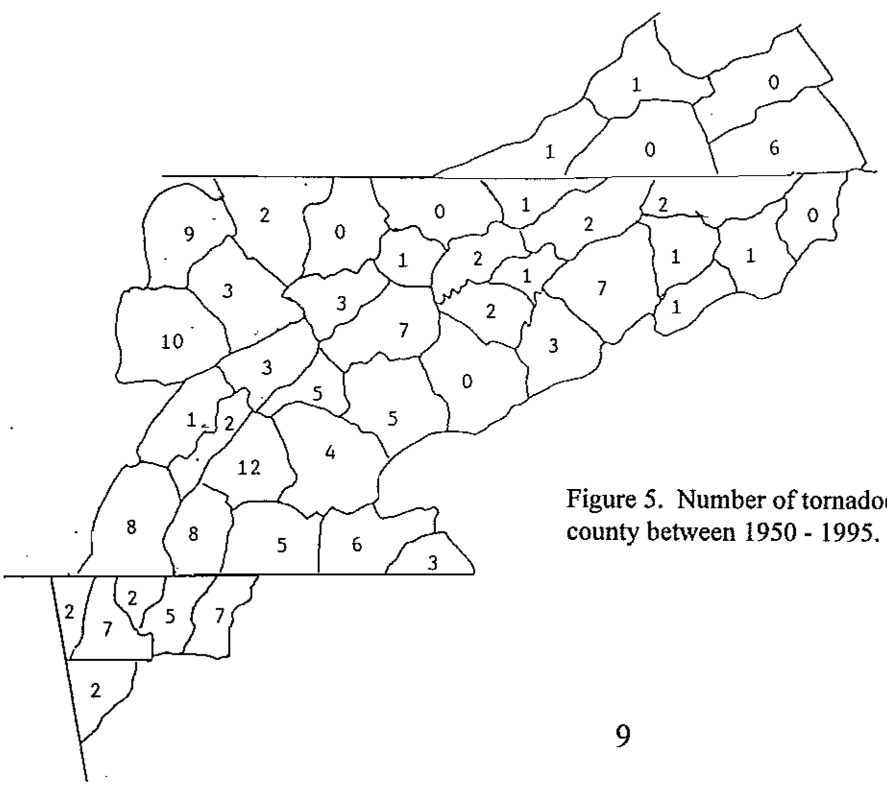


Figure 5. Number of tornadoes (of all in densities) reported in each county between 1950 - 1995.

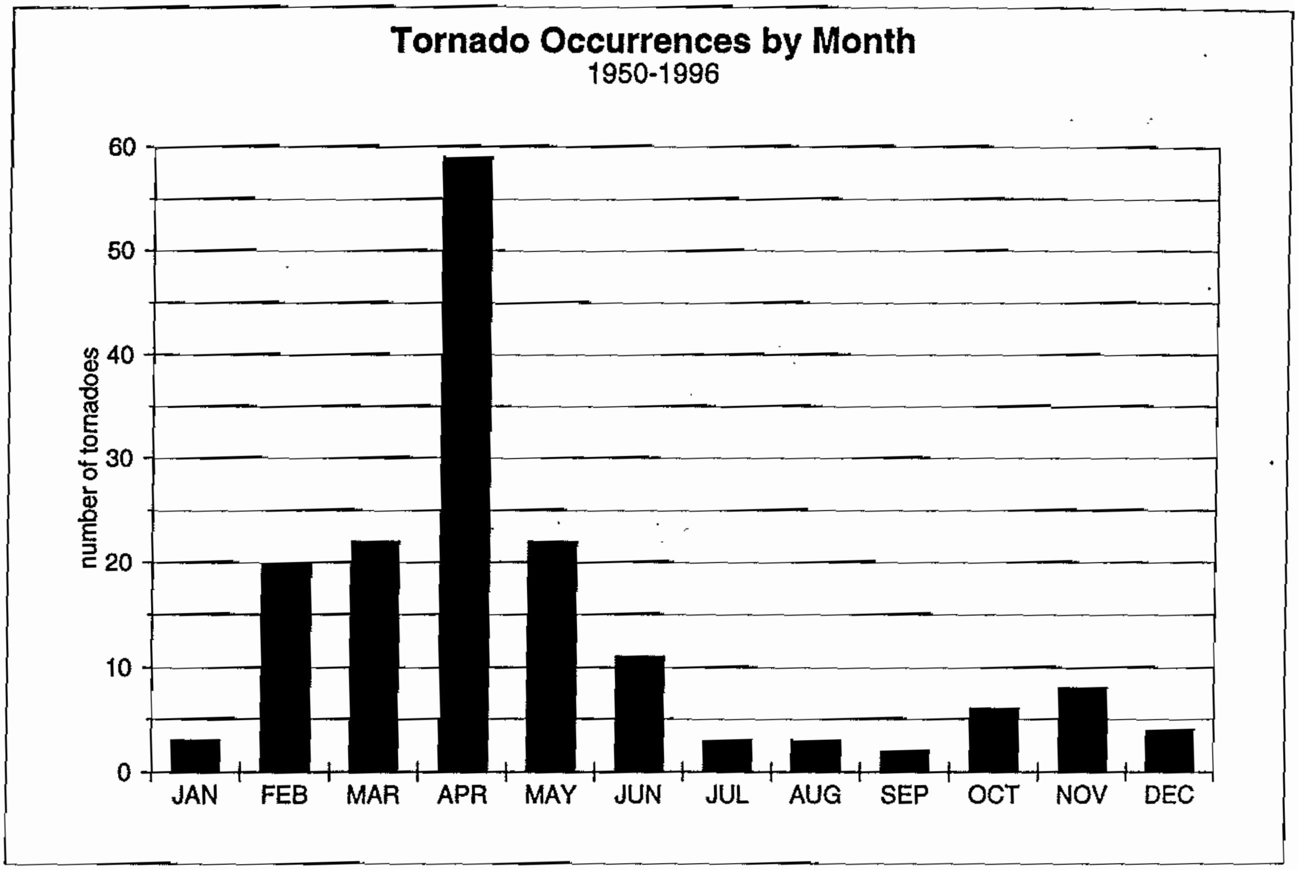


Figure 6.

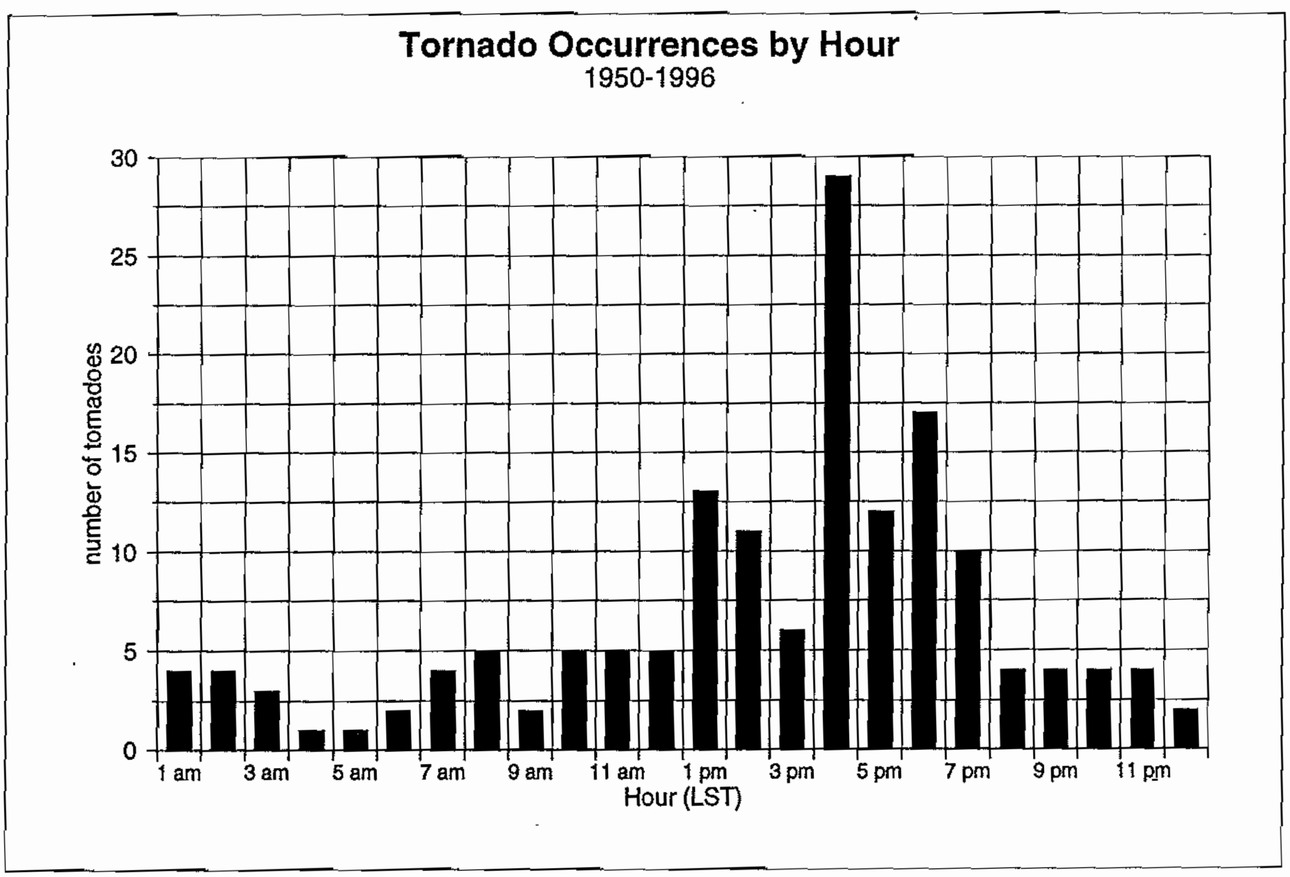


Figure 7.

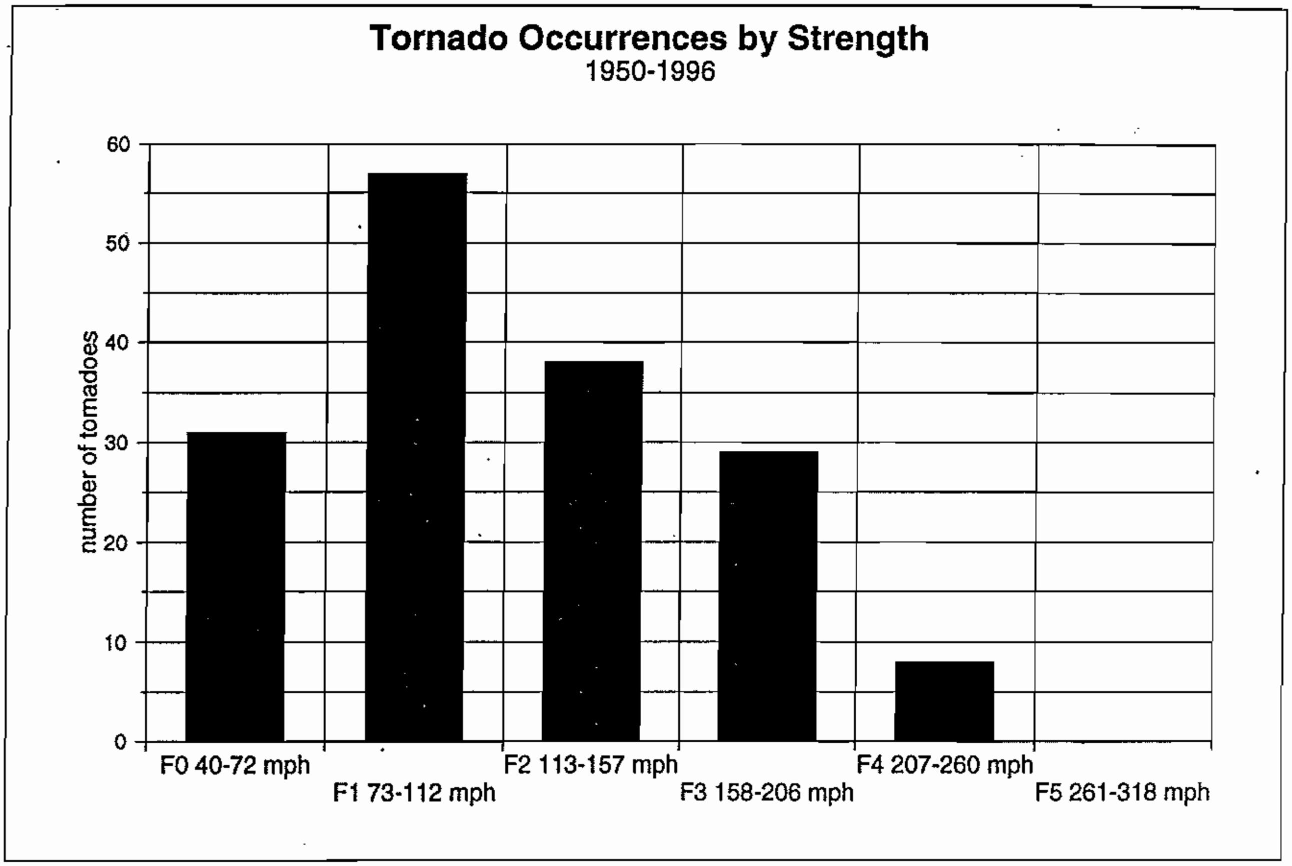


Figure 8.

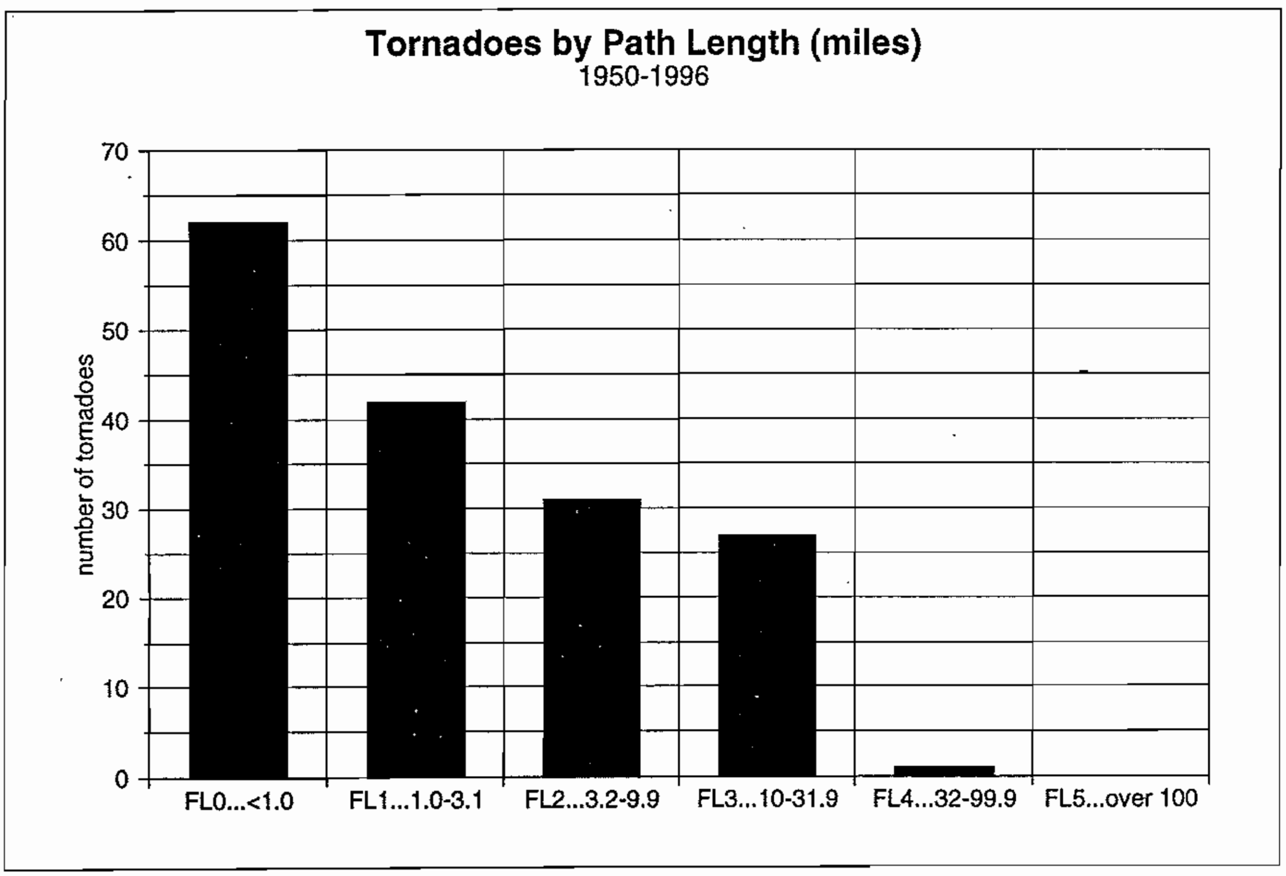


Figure 9.

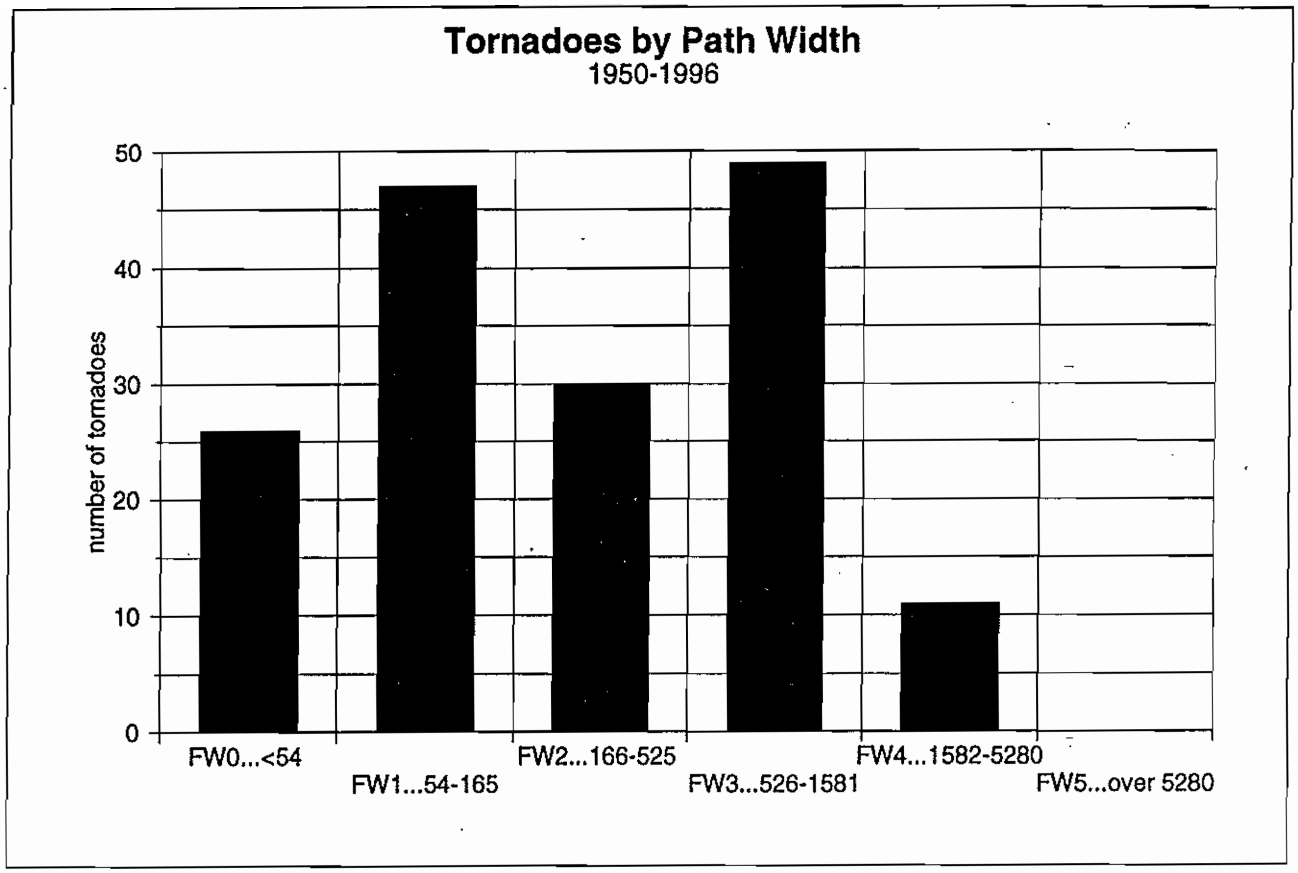


Figure 10. Number of tornadoes by path width (ft.).

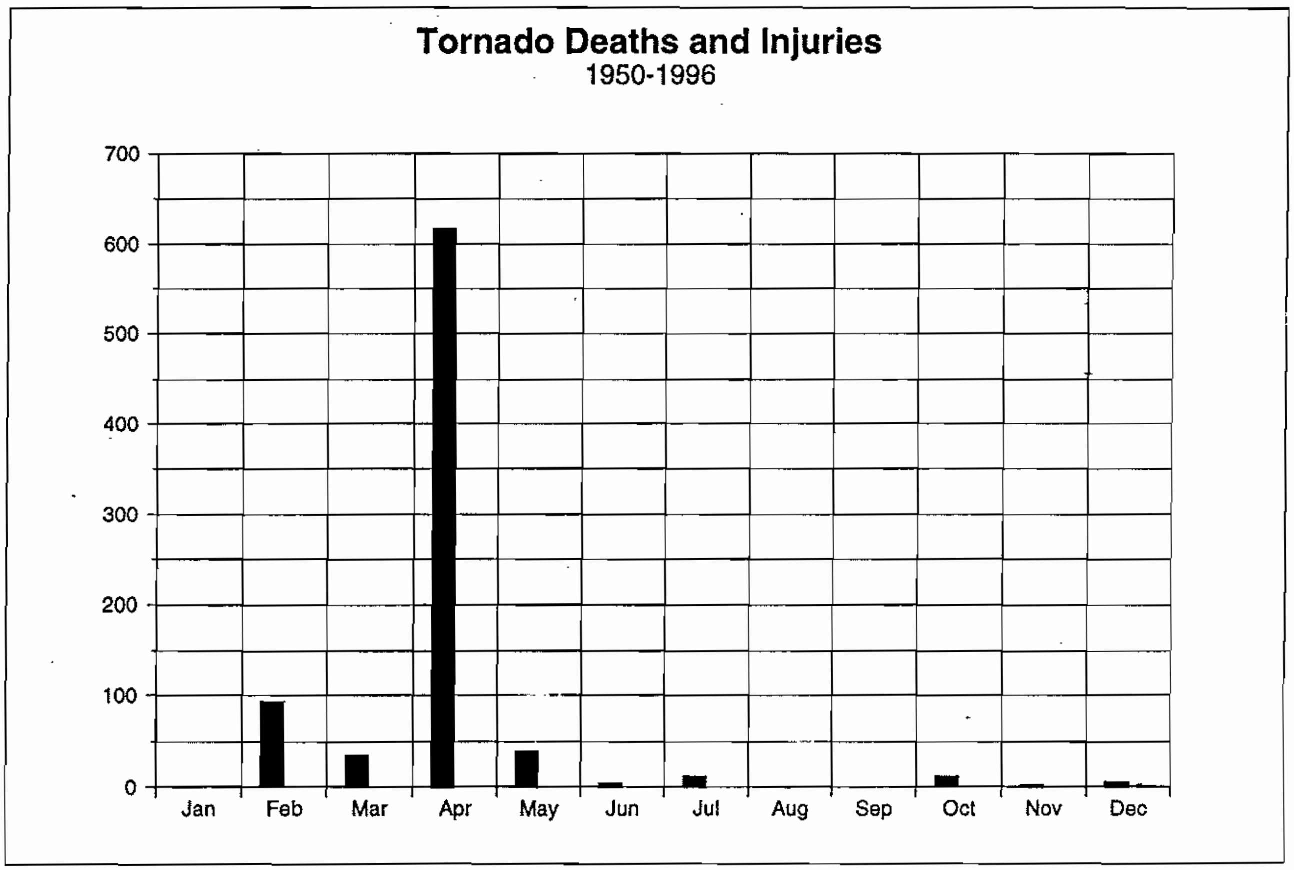


Figure 11.

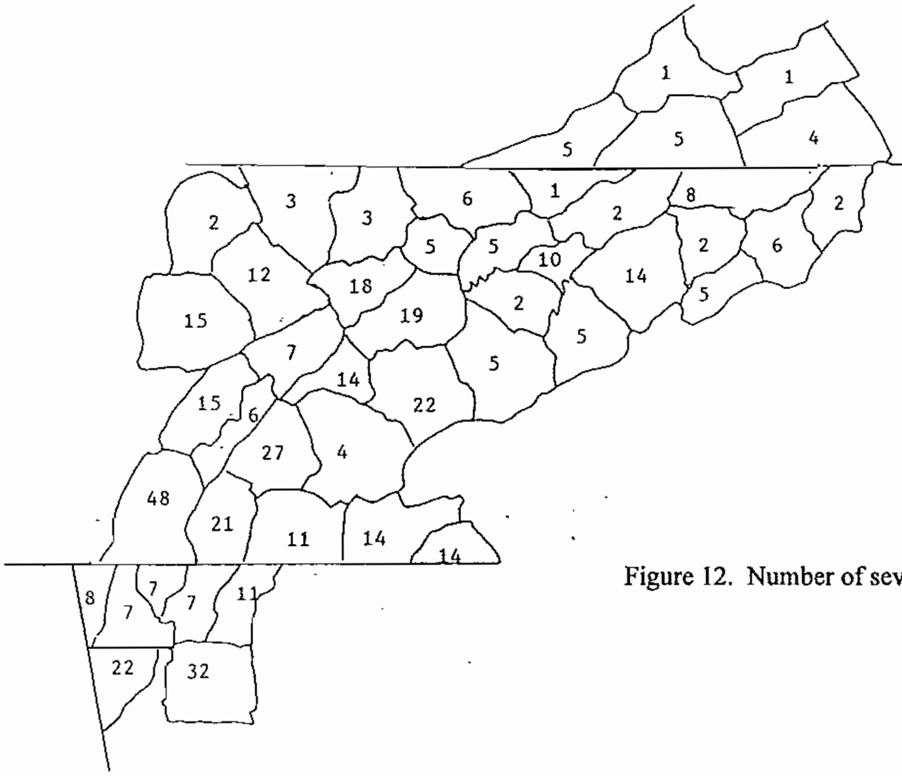


Figure 12. Number of severe hail reports by county, 1955-1995.

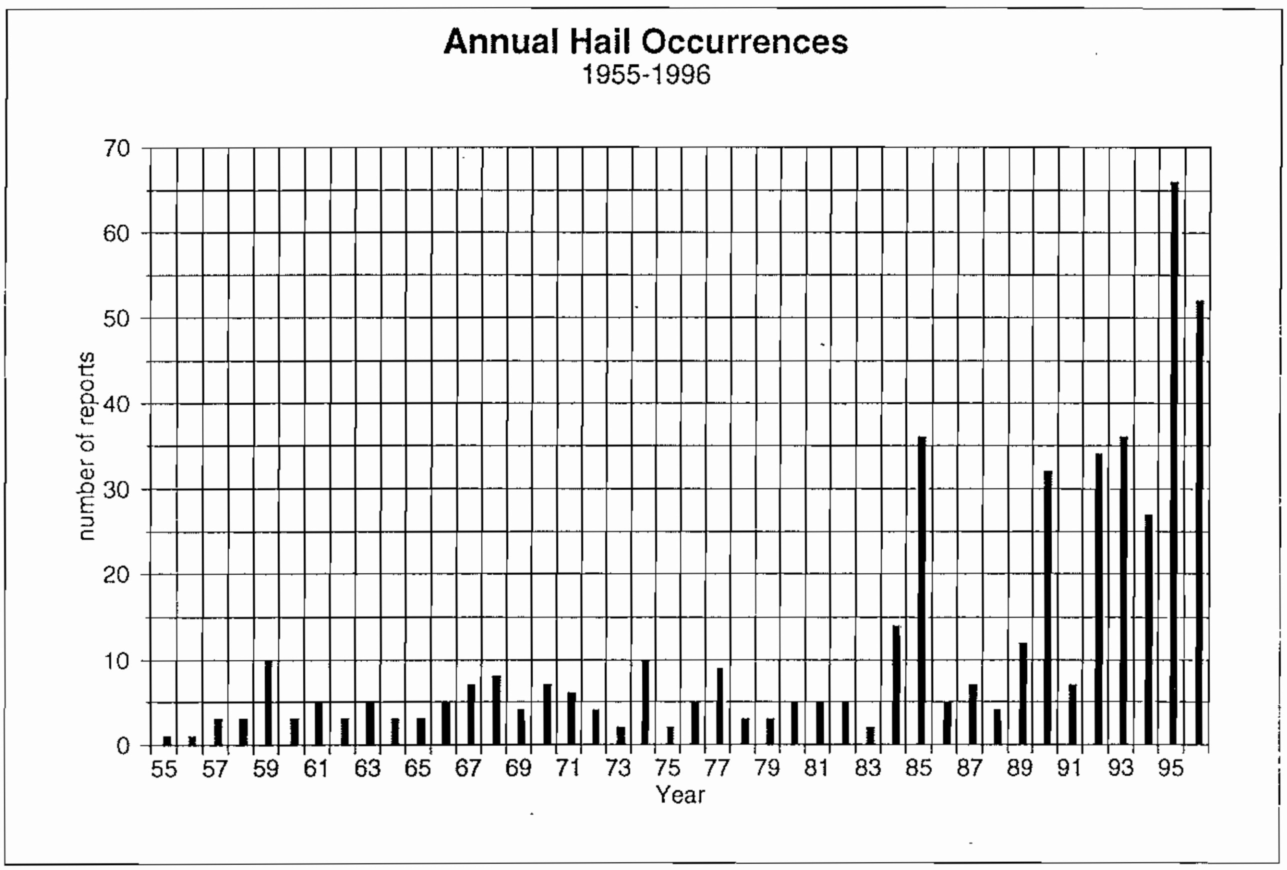


Figure 13.

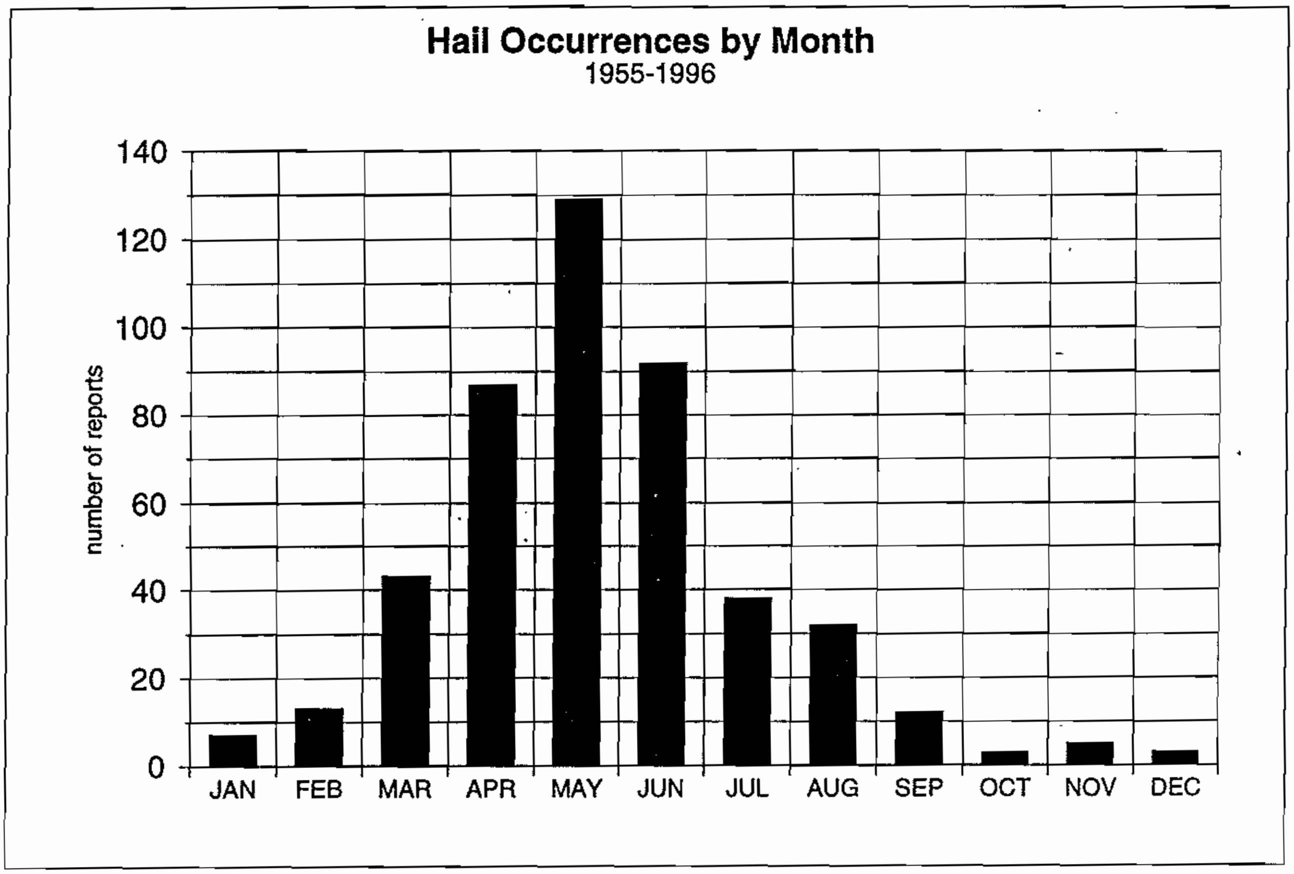


Figure 14.

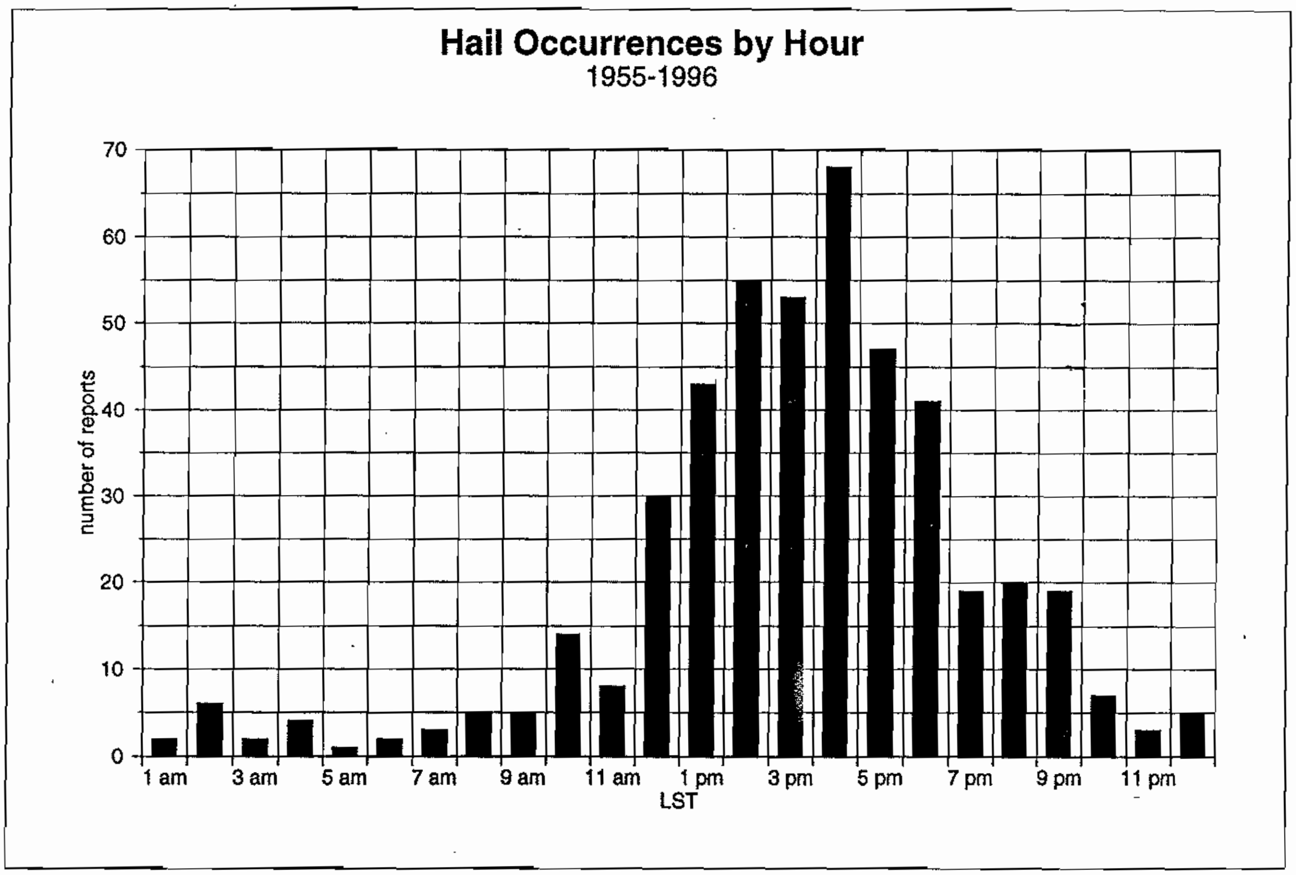


Figure 15.

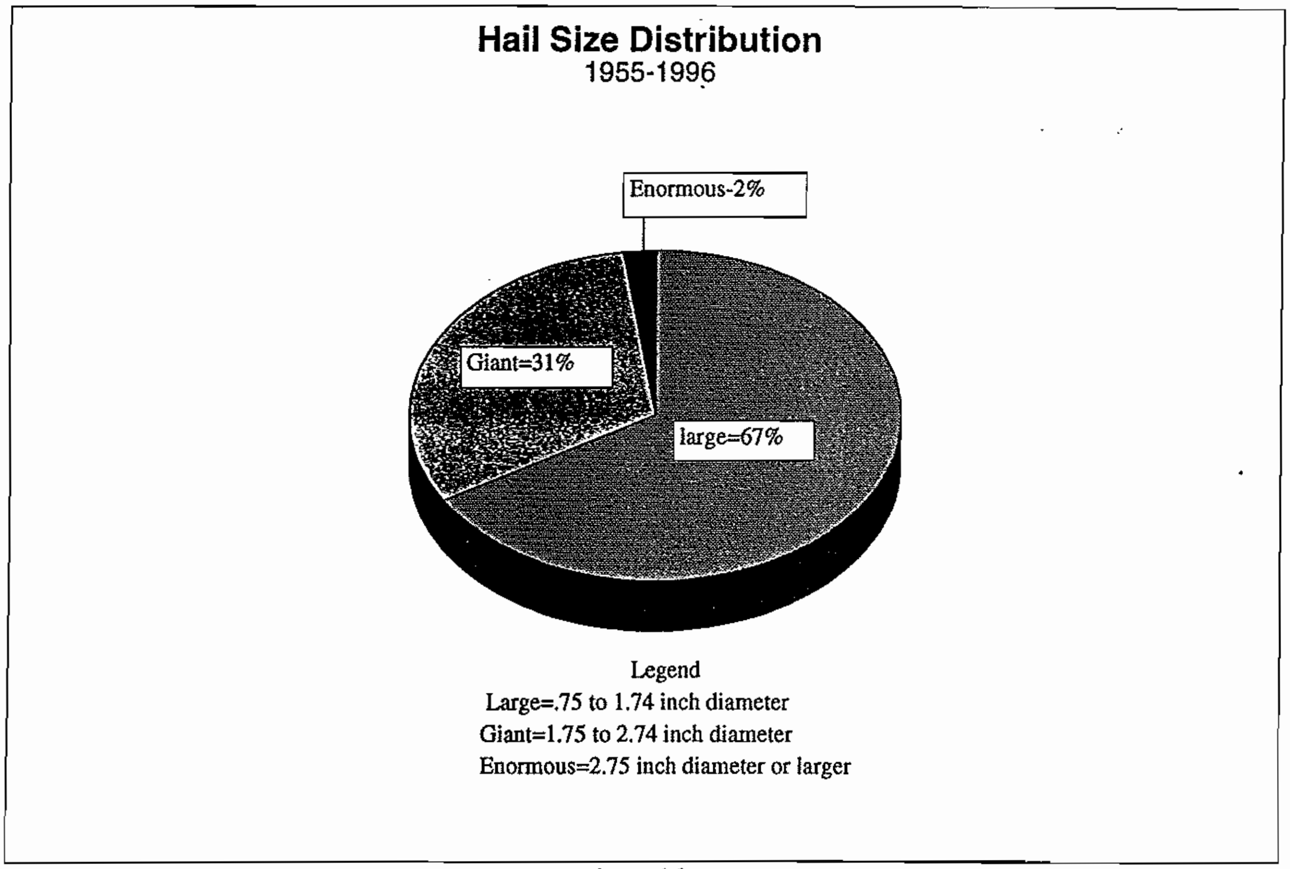


Figure 16.

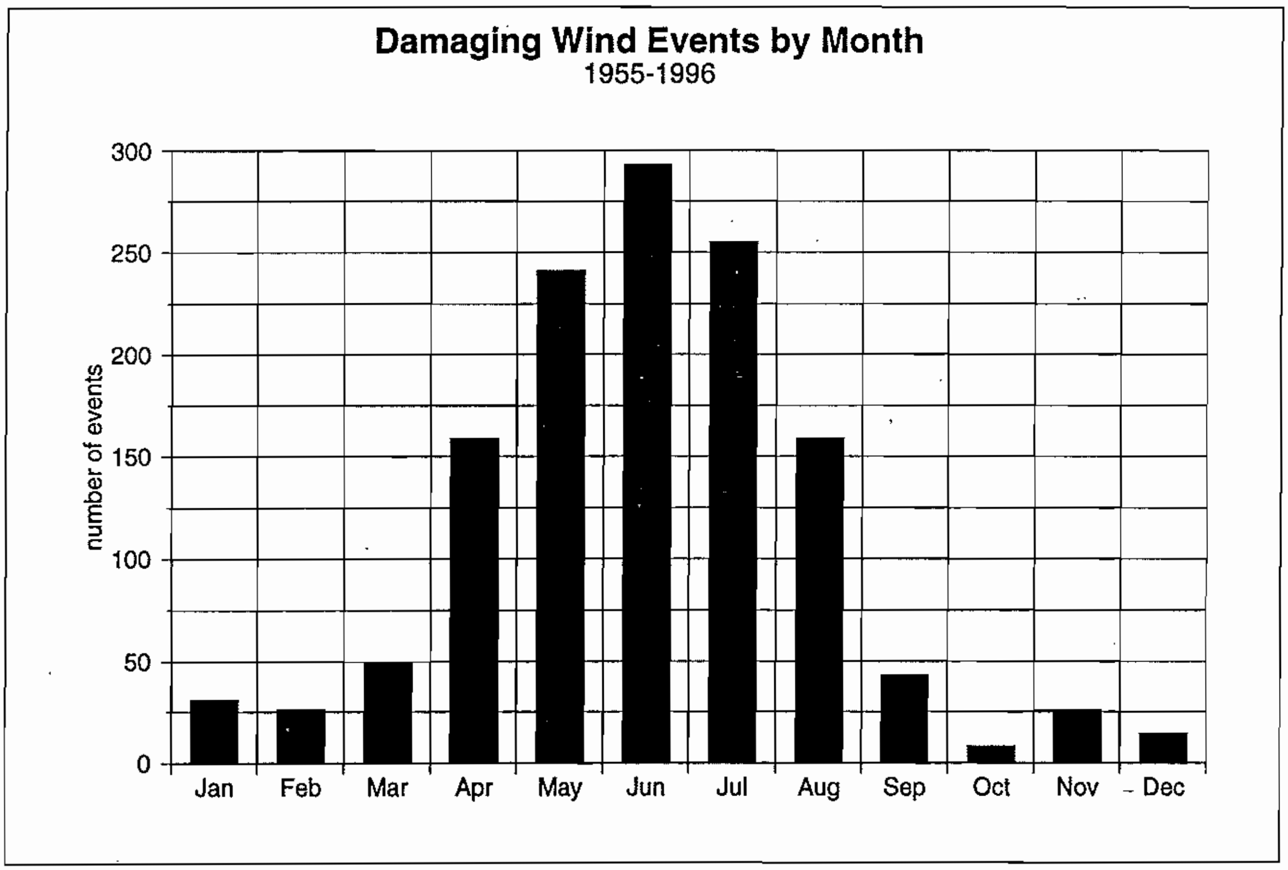


Figure 17.

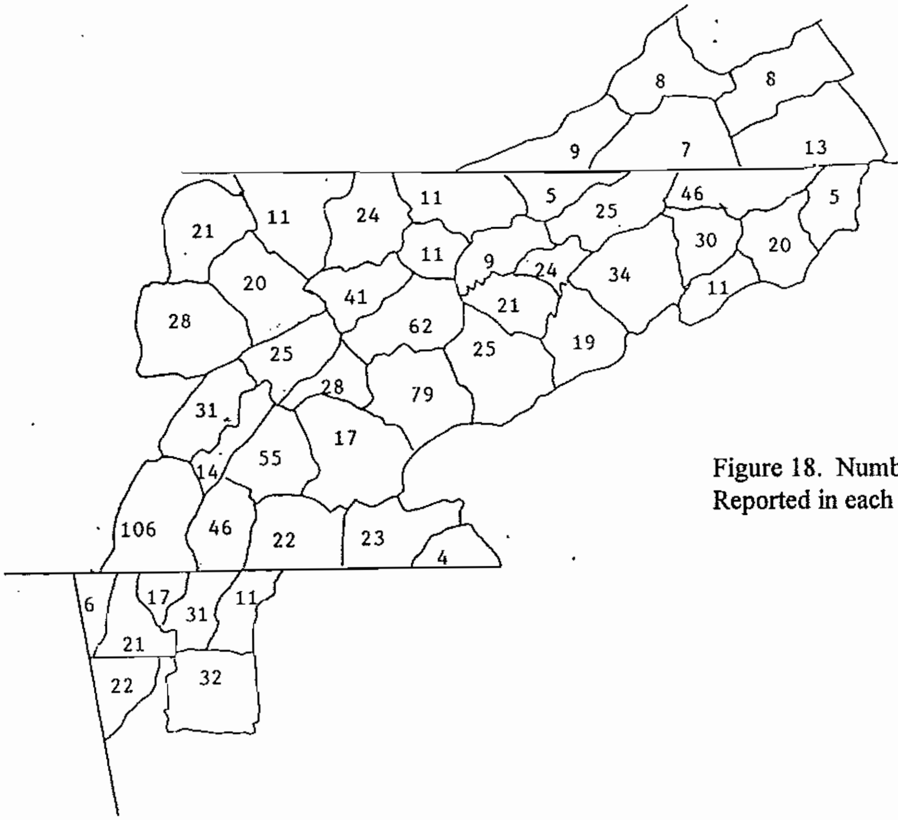


Figure 18. Number of severe thunderstorm wind events Reported in each county, 1955 - 1995.

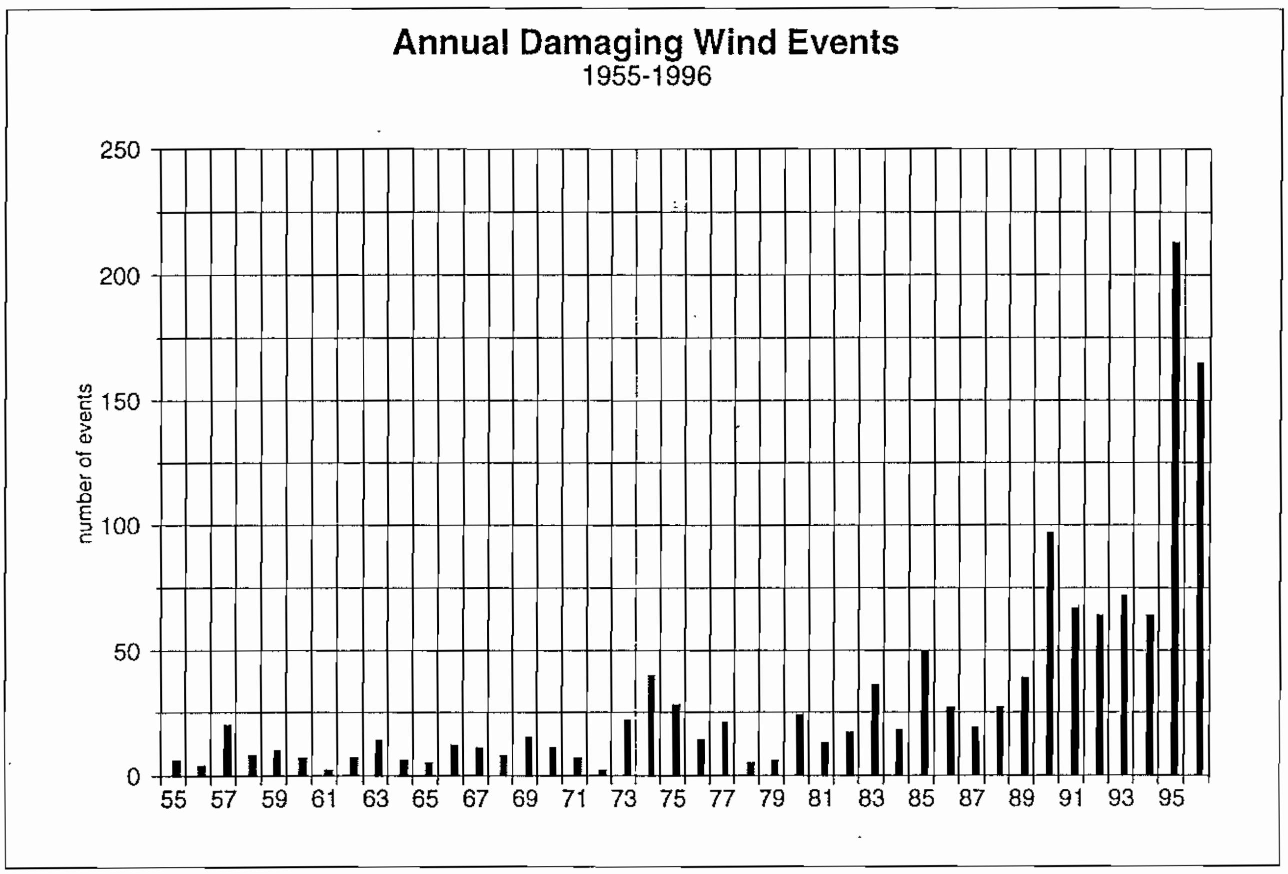
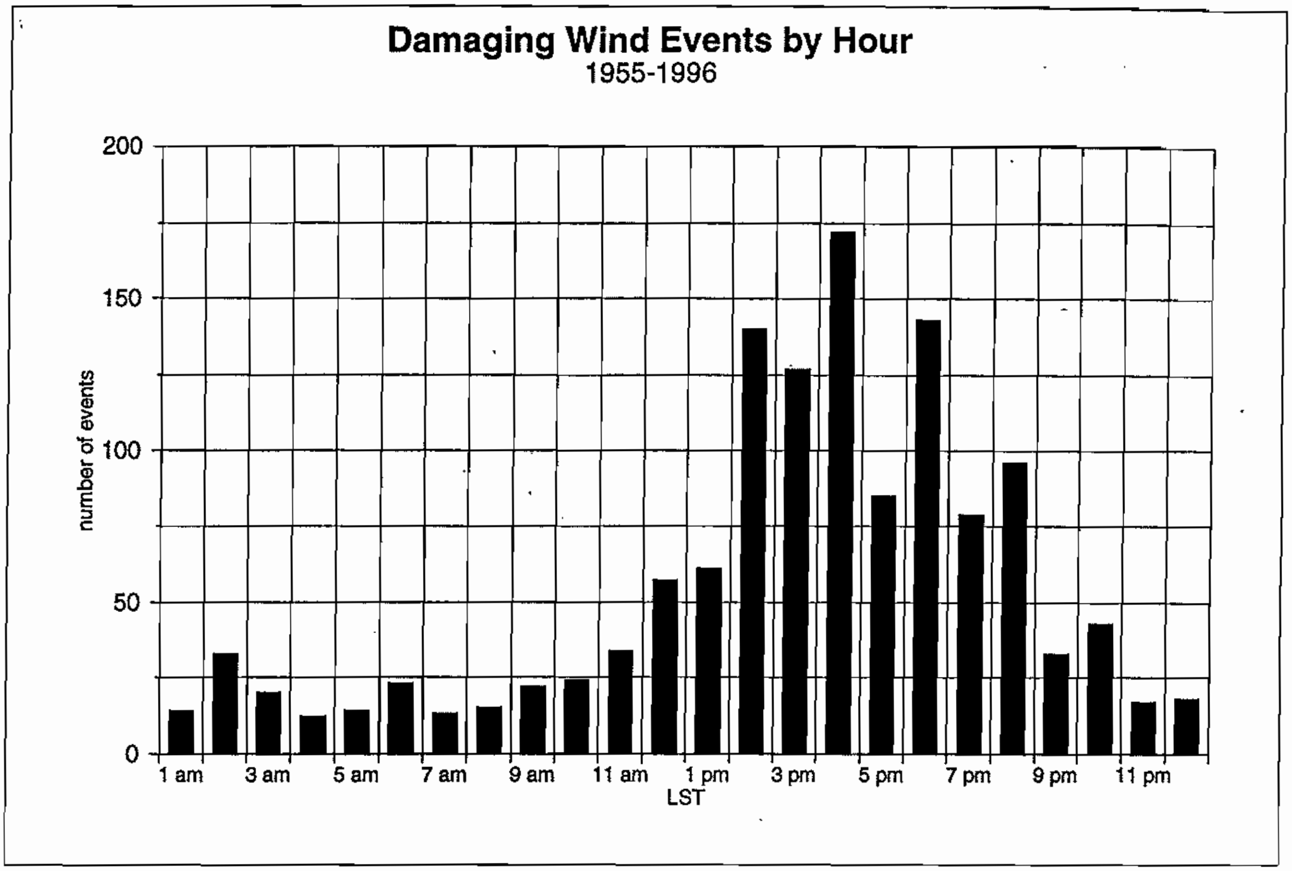


Figure 19.



Damaging Wind Events by Hour
1955-1996
200
150
100
50
0
number of events
1 am
3 am
5 am
7 am
9 am
11 am
1 pm
3 pm
5 pm
7 pm
9 pm
11 pm
LST

Figure 20.

Appendix - Tornadoes Reported in Knoxville/Tri-Cities (Morristown) County Warning Area

County	Date	Time	Death	Injury	Damage Code *	F-Scale	Length Miles	Width Feet
Whitfield, GA	5/30/50	1400	0	0	3	1	0.5	20
McMinn, TN	2/29/52	1730	0	0	5	2	15.3	1,760
Washington, VA	4/30/53	1745	0	0	3	0	1	660
Washington, VA	6/10/53	1400	0	0	3	1	N/A	N/A
Anderson, TN	5/2/53	0215	0	0	3	2	1	300
Meigs, TN	5/2/53	0300	4	8	5	4	2.3	100
McMinn, TN	5/2/53	0310	0	0	3	4	2	100
Hawkins, TN	3/5/55	1900	0	0	5	2	4.3	900
Greene, TN	3/25/55	1630	0	0	4	1	2.0	900
Jefferson, TN	3/25/55	1730	0	0	3	2	16.3	5,280
Fentress, TN	2/17/56	2200	0	2	4	1	0.1	20
Walker, GA	2/18/56	0030	0	0	6	2	22.9	300
Fentress, TN	2/27/56	1730	0	0	3	1	0.1	20
Wise, VA	4/5/57	1240	0	3	4	1	N/A	N/A
Cumberland, TN	4/8/57	0600	0	0	3	2	2.7	30
Washington, TN	4/8/57	1530	0	0	3	2	3.0	1,320
Fentress, TN	11/18/57	1630	0	2	4	2	13.9	660
Catoosa, GA	3/8/61	0145	0	0	5	2	15.2	1,800
Washington, VA	6/3/62	1500	0	0	4	2	N/A	N/A
Cocke, TN	3/11/63	2100	1	1	5	2	6.2	600
McMinn, TN	3/19/63	1830	0	1	4	2	3.6	600
Bradley, TN	3/19/63	1815	0	3	5	2	3.3	450
Clay, NC	1/10/65	0815	0	0	3	1	N/A	N/A
Loudon, TN	3/17/65	1147	0	0	3	1	0.1	20
Morgan, TN	3/17/65	1100	0	0	3	1	0.1	20
Fentress, TN	4/15/65	1350	0	0	4	2	5.9	980
Cumberland, TN	4/15/65	1613	1	0	5	3	6.5	600
Bradley, TN	4/15/65	1625	0	50	6	3	10.4	1,800
Knox, TN	4/15/65	1730	0	6	6	2	7.4	600
Greene, TN	3/12/67	0530	1	5	5	2	16	900
Greene, TN	4/22/67	0705	0	0	5	2	0.2	750

County	Date	Time	Death	Injury	Damage Code *	F-Scale	Length Miles	Width Feet
Walker, GA	5/12/67	0815	0	0	2	1	0.5	100
Fentress, TN	5/14/72	2030	0	3	4	2	1	150
Cumberland, TN	6/28/72	1300	0	0	4	2	0.1	120
Blount, TN	6/28/72	1740	0	3	5	1	0.5	80
Grainger, TN	5/10/73	2130	0	0	3	1	N/A	N/A
Walker, GA	5/27/73	1800	0	0	3	1	N/A	150
Cumberland, TN	5/23/73	1600	0	0	4	1	1	300
Polk, TN	12/13/73	0750	0	3	5	2	0.8	2,640
Greene, TN	12/13/73	1000	0	1	4	1	0.5	1,320
Whitfield, GA	1/11/74	0445	0	0	4	1	N/A	N/A
Cherokee, NC	4/2/74	0001	0	0	4	1	16.8	N/A
Polk, TN	3/21/74	0040	0	7	5	2	0.8	900
Lee, VA	4/4/74	0121	0	0	2	0	8.6	50
Cherokee, NC	4/3/74	1600	0	0	N/A	1	N/A	N/A
Washington, VA	4/4/74	0300	1	1	5	3	5.4	530
Polk, TN	4/3/74	1315	0	0	3	3	2.7	1,050
Blount, TN	4/3/74	1400	0	2	5	2	0.5	150
Cherokee, NC	4/3/74	1925	4	26	7	4	18.9	1,050
McMinn, TN	4/3/74	1430	1	32	3	1	3.6	80
Cherokee, NC	4/4/74	0700	0	0	4	0	9.7	N/A
Hamilton, TN	4/3/74	1450	0	2	4	1	5.9	80
Loudon, TN	4/3/74	1600	0	2	5	2	N/A	300
Monroe, TN	4/3/74	1600	0	0	5	2	1.0	600
Bradley, TN	4/3/74	1615	2	0	5	3	9.7	1,500
Polk, TN	4/3/74	1625	1	0	5	3	5.4	1,500
McMinn, TN	4/3/74	1630	0	50	5	3	6.1	1,500
Whitfield, GA	4/3/74	1650	2	25	6	4	3.3	450
Fentress, TN	4/3/74	1815	0	0	4	2	7.9	1,200
Clay, NC	12/5/74	0355	0	0	4	1	7.7	50
Fentress, TN	4/3/74	1950	7	150	6	4	18.8	600
Cocke, TN	4/3/74	2100	0	0	3	0	0.5	80
Morgan, TN	4/3/74	2250	0	6	4	3	3.6	1,050
Scott, TN	4/3/74	2255	0	5	N/A	3	8.6	1,050
Scott, TN	4/3/74	2250	0	21	5	3	13.0	1,200
Cumberland, TN	4/3/74	2335	0	20	5	2	12.9	900

County	Date	Time	Death	Injury	Damage Code *	F-Scale	Length Miles	Width Feet
Knox, TN	4/3/74	2330	2	21	4	1	1.0	450
Anderson, TN	4/4/74	0030	0	0	3	0	8.7	600
Jefferson, TN	4/4/74	0100	0	0	4	0	4.5	80
Hawkins, TN	4/4/74	0130	0	0	3	0	0.5	80
Sullivan, TN	4/4/74	0200	0	2	5	0	13.8	750
McMinn, TN	4/8/74	1115	0	1	5	3	2.0	1,320
Washington, TN	1/25/95	2230	0	0	4	2	1.3	90
Monroe, TN	3/7/75	1220	0	3	4	1	9.4	960
Blount, TN	3/7/75	1240	0	0	4	1	0.5	600
Greene, TN	3/24/75	0730	0	0	4	1	0.5	300
Cumberland, TN	4/25/75	1530	1	4	5	2	1.5	1,320
Cocke, TN	2/18/76	1307	0	10	6	2	1.0	100
Greene, TN	6/24/77	1630	0	0	4	1	3.8	300
Hamilton, TN	8/12/77	1830	0	0	4	0	0.1	50
Cumberland, TN	9/25/77	1400	0	0	3	0	5.1	300
Sullivan, TN	10/1/77	1435	0	10	6	1	16.2	230
Grainger, TN	10/1/77	1545	0	2	5	0	2.0	100
Union, TN	10/1/77	1915	0	0	5	1	4.3	1,320
Roane, TN	10/1/77	2315	0	0	4	0	0.2	300
McMinn, TN	12/5/77	0840	0	1	5	1	5.1	300
Cherokee, NC	9/21/79	1615	0	0	4	0	0.1	300
Blount, TN	3/7/80	1730	0	0	3	1	0.1	60
Clay, NC	2/25/80	1615	0	0	2	0	N/A	N/A
Bradley, TN	4/8/80	1631	0	0	4	1	5.2	150
Monroe, TN	4/28/80	1705	0	1	5	2	3.3	150
Hamilton, TN	6/24/80	1520	0	0	4	0	N/A	N/A
Hancock, TN	7/6/80	1300	0	0	5	2	11.5	900
Unicoi, TN	7/10/80	1230	0	12	5	3	1.9	300
Knox, TN	5/27/81	1840	0	0	4	0	0.4	150
Rhea, TN	6/4/83	0115	0	0	5	1	20.0	150
Walker, GA	5/19/83	1745	0	1	5	1	2.0	150
Whitfield, GA	5/19/83	1800	0	3	5	1	0.5	90
Fentress, TN	5/7/84	1530	0	0	4	1	0.5	90
Loudon, TN	5/7/84	1720	0	0	5	2	1.0	210

County	Date	Time	Death	Injury	Damage Code *	F-Scale	Length Miles	Width Feet
Dade, GA	10/23/84	1705	0	0	4	1	1.0	110
Hamblen, TN	11/27/85	1400	0	0	4	1	2.0	120
Bradley, TN	2/6/86	1618	0	5	6	3	5.0	810
Polk, TN	2/6/86	1628	0	0	6	3	2.0	810
McMinn, TN	2/6/86	1638	0	0	6	3	3.0	810
Carter, TN	6/16/89	1400	0	0	4	1	1.0	90
Bradley, TN	11/15/89	1845	0	0	4	1	3.0	90
Washington, VA	4/30/90	1625	0	0	4	0	0.3	60
Hamilton, TN	10/4/90	0715	0	0	5	1	1.8	70
Cherokee, NC	4/16/91	1530	0	0	4	0	0.5	150
Whitfield, GA	4/24/92	1840	0	0	4	0	0.5	600
Dade, GA	11/22/92	0850	0	0	5	1	3.5	1,500
Walker, GA	11/22/92	0930	0	0	3	1	1.0	450
Catoosa, GA	11/22/92	0933	0	0	3	1	1.0	450
Cumberland, TN	02/21/93	1435	0	0	5	0	5.0	70
Anderson, TN	2/21/93	1535	0	3	6	3	10.0	450
Knox, TN	2/21/93	1605	0	0	6	3	6.0	450
Roane, TN	2/21/93	1605	0	0	4	3	1.5	300
Loudon, TN	2/21/93	1610	1	55	6	3	15.0	300
Blount, TN	2/21/93	1620	0	0	5	3	10.0	300
Roane, TN	2/21/93	1620	0	0	5	1	3.0	70
McMinn, TN	2/21/93	1645	0	7	5	3	4.0	220
Monroe, TN	2/21/93	1650	0	10	6	3	15.0	300
Fentress, TN	5/12/93	1230	0	0	3	0	0.8	70
Knox, TN	6/30/93	0630	0	1	3	0	2.0	30
Knox, TN	6/30/93	1842	0	0	2	0	1.0	20
Hamilton, TN	4/15/94	1030	1	2	6	3	2.0	2,640
Meigs, TN	4/15/94	1034	0	3	6	3	2.0	2,640
Bradley, TN	4/15/94	1036	0	2	6	3	1.0	2,640
McMinn, TN	4/15/94	1040	0	2	6	3	10.0	2,640
McMinn, TN	4/27/94	1215	0	0	2	0	0.1	30
Walker, GA	3/27/94	1255	0	1	4	0	1.5	150
Walker, GA	3/27/94	1315	0	0	5	1	1.0	120
Greene, TN	8/21/94	0700	0	0	1	1	1.0	70
Walker, GA	8/27/94	1255	0	1	4	0	1.5	150

County	Date	Time	Death	Injury	Damage Code *	F-Scale	Length Miles	Width Feet
Hamilton, TN	4/21/95	0020	0	0	5	0	0.1	90
Hamilton, TN	4/21/95	0025	0	0	5	2	5.0	990
Hamilton, TN	4/21/95	0030	0	0	5	1	1.0	900
McMinn, TN	5/10/95	2125	0	0	0	1	3.0	600
Cumberland, TN	5/18/95	1721	0	20	6	3	9.0	300
Morgan, TN	5/18/95	1750	0	0	0	0	0.5	70
Cumberland, TN	5/18/95	1930	0	0	4	1	2.0	70
Knox, TN	5/18/95	2000	0	0	4	1	2.0	70
Loudon, TN	5/18/95	2100	0	0	4	0	1.0	60
Fentress, TN	3/16/96	1630	0	0	4	0	1.0	90
Scott, VA	4/13/96	1611	0	0	4	0	0.5	70
Bradley, TN	5/27/96	1828	0	0	5	0	3.5	30
Russell, VA	7/19/96	1700	0	0	5	1	3.6	50

* Damage Code:

1 - Less than $50
2 - $50 to $500
3 - $500 to $5,000
4 - $5000 to $50,000
5 - $50,000 to $500,000
6 - $500,000 to $5 million
7 - $5 million to $50 million
8 - $50 million to $500 million
9 - $500 million to $5 billion